INDIANACTSI
Clinical and Translational Sciences Institute

STANDARD OPERATING PROCEDURE
Indiana CTSI Specimen Storage Facility

TITLE: STANDARD OPERATING PROCEDURE FOR LIQUID NITROGEN FREEZERS

CHAPTER: 3-Equipment

SOP #: SF-3-2.07

SUPERSEDES SOP #: N/A

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AUTHORED BY: _____ DATE: 11-29-16
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APPROVAL: _____ DATE: 02 DEC 2016
Indiana CTSI SSF Director

QA APPROVAL: _____ DATE: 12.05.16
Quality Compliance Specialist

1. REVISION
   1.1. Significant changes incorporated in this version include:
      1.1.1. Added reference to SF-3-16 to section 2 for -80°C LN_2 freezer procedures.
      1.1.2. Deleted the requirement for ETOH to be critical environment grade from section 5 and references to critical environment grade for step 6.1.4.1.2.
      1.1.3. Revised level verification requirements in step 6.1.1.2.3 and section 6.1.1.2.4.
      1.1.4. Wipe downs revised to occur quarterly versus monthly. Step 6.1.2, section 9, and Appendices A & B revised accordingly.
      1.1.5. Added directive to complete OOS per SF-1-10 to step 6.1.4.7.
      1.1.6. Added section 6.1.5.4 with directives to complete after vendor PM.
      1.1.7. Added section 6.1.6 for directives to complete in the event of OOS temperature.
      1.1.8. Added further clarification to step 6.2.3 for overfill events.
      1.1.9. Appendix B updated to include review requirement for each section (quarterly, semi-annual, and annual).

2. PURPOSE
   2.1. This Standard Operating Procedure (SOP) defines the procedures used in the Indiana CTSI Specimen Storage Facility (SSF) to maintain and monitor the liquid nitrogen freezers owned or contracted for storage in the SSF. This procedure satisfies guidance set forth in ISBER. Refer to SOP SF-3-16 for procedures used to maintain and monitor -80°C LN_2 freezers.

3. PRINCIPLE
   3.1. All liquid nitrogen freezers owned or contracted for storage in the SSF are supported by ICTSI SSF Staff. The refrigeration units store samples for which defined storage conditions are critical. Routine monitoring and maintenance is important to minimize risk of the units failing to maintain specified storage conditions and for quickly detecting out of specification (OOS) conditions.

4. SCOPE
   4.1. The SOP applies to personnel operating and maintaining the liquid nitrogen freezers owned or contracted for storage in the SSF. This SOP is applicable to all vapor phase and liquid phase storage units in the SSF. It provides the schedule and procedures for monitoring and maintaining the units and defers response to OOS conditions to SOP SF-1-10 SOP for Out of Specification Condition Notification and Management. Alarming and response is managed via SOP SF-2-4 Alarm Systems Management and Response and safety relevant to the liquid nitrogen is addressed in SF-2-2 SOP for LN_2 System and Freezer Room Operations.

5. MATERIALS
   5.1. Cleaning Cloth
   5.2. General Purpose Cleaner (Example: Windex)
   5.3. 70% ETOH
   5.4. NIST-traceable thermometer (SF-3-7)

6. PROCEDURE:
   6.1. **Routine Monitoring and Maintenance**
   Note: At unit intake, complete/update Appendix C to include by location: S/N, acceptable temperature range and LN_2 Levels
   6.1.1. **Daily**
   6.1.1.1. Temperature checks
   6.1.1.1.1. Observe the temperature from the digital display for each probe of each unit.
   6.1.1.1.1.1. Acceptable Ranges: Refer to Appendix C for S/N specific ranges.

   6.1.1.1.2. If within acceptable range, record, date and initial. (Appendix A)

   6.1.1.1.3. If temperature is outside of acceptable range:
   6.1.1.1.3.1. If temperature is colder than lower limit of either range, record and notify SSF Management.
   6.1.1.1.3.2. If temperature exceeds upper limit of either range by greater than 20^{o} C, check back in 15 minutes to see if the temperature has recovered to the point where it exceeds the upper limit by less than 20^{o} C.
   6.1.1.1.3.2.1. If the unit has recovered to this point, proceed to next section.
   6.1.1.1.3.2.2. If the unit has still not recovered, notify SSF management and proceed per SF-1-10 SOP for Out of Specification Condition Notification and Management.

   6.1.1.1.3.3. If temperature exceeds upper limit of one or both ranges by less than 20^{o} C, record and set a reminder to re-check in approximately 15 minutes.
   6.1.1.1.3.3.1. If unit is recovered, record and accept.
   6.1.1.1.3.3.2. If unit is approaching recovery, repeat this step up to 7 times (i.e., for up to 2 hours). If unit reaches acceptable range, record and accept. If unit fails to reach acceptable level, notify SSF Management and correct if possible. If unable to resolve, proceed

per SF-1-10 SOP for Out of Specification Condition Notification and Management.

6.1.1.1.4. Document results and any actions taken on the LN2 Freezers Daily Monitoring Log (Appendix A).

6.1.1.2. LN_2 Level

6.1.1.2.1. Observe the liquid nitrogen level from the digital display for each unit.

6.1.1.2.1.1. Acceptable Range: Refer to Appendix C for S/N specific ranges.

6.1.1.2.2. If within acceptable range, record, date and initial. (Appendix A)

6.1.1.2.3. If level is below acceptable range:

6.1.1.2.3.1. If level is greater than 1 inch below acceptable level, take a manual reading (per step 6.1.3.1). Document both the display and manual readings and notify SSF Management. Document OOS condition per SF-1-10 SOP for Out of Specification Condition Notification and Management.

6.1.1.2.3.2. If level is less than 1 inch below lower limit, fill and set a reminder to re-check in approximately 15 minutes.

6.1.1.2.3.2.1. If unit is recovered, record and accept.

6.1.1.2.3.2.2. If unit is approaching recovery, repeat step 6.1.1.2.3.2 up to 3 times. If unit reaches acceptable range, record and accept. If unit fails to reach acceptable level, notify SSF Management and correct if possible. If unable to resolve, document OOS condition per SF-1-10 SOP for Out of Specification Condition Notification and Management.

6.1.1.2.4. LN_2 levels above the acceptable range are defined as overfills. Overfills may pose a danger to the specimens within the affected unit and are a potential danger to samples, staff, equipment and/or the facility, given the hazardous nature of Liquid Nitrogen that is not adequately contained. Overfills must be monitored carefully to mitigate potential dangers.

6.1.1.2.4.1. If the LN_2 level is < 1 inch above the maximum acceptable LN_2 level, no action required. Record and accept.

6.1.1.2.4.2. If the LN_2 level is ≥ 1 inch above the maximum acceptable LN_2 level, or in response to a unit alarm or a Siemens alarm, proceed as follows:

6.1.1.2.4.2.1. Close supply valve for affected freezer and affix signage to unit to indicate disconnect.

6.1.1.2.4.2.2. Verify level per section 6.1.3.1.

6.1.1.2.4.2.3. Notify PI and SSF Management, including which boxes if any are submerged.

6.1.1.2.4.2.4. Document OOS condition per SF-1-10 SOP for Out of Specification Condition Notification and Management.

6.1.1.2.4.2.5. Additionally (in the event of a Siemens alarm) increase the high level LN_2 alarm setpoint to be sufficiently above the PI-

specified level to ensure that other daisy-chained units can continue to communicate with the Siemens system. Affix signage to the unit to indicate this change in alarm setpoint. Document all actions on the OOS form and the impacted unit's temperature log (Appendix A).

6.1.1.2.4.2.5.1. If PI has documented directives on file with the SSF to prohibit LN_2 level setpoint changes, disconnect malfunctioning unit from alarm system and notify PI.

6.1.1.2.4.2.6. Once the LN_2 level has returned to normal, the supply may be turned back on and the high LN_2 level alarm setpoint returned to the PI-specified value. Remove applicable signage. Document actions on the OOS form and the impacted unit's temperature log (Appendix A).

6.1.1.2.4.2.7. If more than one overfill event is documented for a given unit within a 3 month period, the SSF Director contacts the PI to discuss the plan for adequate resolution.

6.1.1.2.5. Document results and any actions taken on the LN_2 Freezers Daily Monitoring Log (Appendix A).

6.1.2. **Quarterly**

6.1.2.1. Wipe down the outside of the units with a cloth and general purposes cleaner.

6.1.2.2. Record actions, date and initials on LN_2 Freezer Quarterly, Semi-Annual, and Annual Monitoring and Maintenance Log (Appendix B).

6.1.3. **Semi-Annually**

NOTE: Before completing any of the following, consider directives in Section 6.1.5, if applicable.

6.1.3.1. Digital Liquid Nitrogen Level Display Verification

6.1.3.1.1. Open lid.

6.1.3.1.2. Clean black ruler by spraying with 70% ETOH. It is not necessary to allow the alcohol to evaporate.

6.1.3.1.3. Place black ruler into open slot in carousel.

6.1.3.1.4. Insert ruler to bottom of tank.

6.1.3.1.5. Leave ruler in for ten seconds.

6.1.3.1.6. Remove ruler.

6.1.3.1.7. Read the ruler at the point where the white vapor is present on the black. If the white vapor line is not visible, wave the ruler back and forth until line becomes visible.

6.1.3.1.8. Compare level to digital readout.

6.1.3.1.9. Acceptable range is ± 1 inch.

6.1.3.1.10. If difference exceeds 1 inch, LN_2 level is not within acceptable range.

6.1.3.1.10.1. If unit is SSF-owned, notify SSF management and correct if possible. Initiate repair if warranted.

6.1.3.1.10.2. If unit is not SSF-owned, notify SSF management as well as the owner of the unit. Corrective action is the responsibility of the owner.

6.1.3.1.10.3. Document OOS conditions per SF-1-10 SOP for Out of Specification Condition Notification and Management.

6.1.3.1.11. Record results on Appendix B.

6.1.4. **Annually**

NOTE: Before completing any of the following, consider directives in Section 6.1.5, if applicable.

6.1.4.1. Temperature display calibration verification

6.1.4.1.1. Place a notice on the LN_2 Freezer stating "CALIBRATION IN PROCESS – DO NOT OPEN".

6.1.4.1.2. Place the probe (cleaned with ETOH) of an NIST-traceable thermometer capable of reading within expected range and within calibration limits and time per SOP SF-3-7 Thermometer inside the unit, as close as possible to the freezer probe.

6.1.4.1.2.1. The freezer probe is located near the top of the racks, in the center of the freezer, within a column of metal.

6.1.4.1.2.2. Place the NIST probe at the level of the top of a rack, as close to the middle of the freezer as possible without allowing the NIST probe to touch anything; this is accomplished by threading the probe through the handle of a rack.

6.1.4.1.3. Wait at least 20 minutes, until thermometer is stabilized.

6.1.4.1.4. Read NIST thermometer.

6.1.4.1.5. Compare NIST thermometer with digital readout. If the freezer unit has two probes, read the digital readout of the top probe.

6.1.4.1.6. Record the digital readout and the NIST thermometer reading on Appendix B.

6.1.4.1.7. Determine whether or not the temperature calibration verification is successful by following the instructions on Appendix D and utilizing the Excel LN_2 temperature display verification spreadsheet calculator located in the shared folder. Performance of the calculation listed below (and in the spreadsheet calculator) will yield a "True" result if the verification passes and "False" result if the verification fails:

|NIST reading-unit digital display| ≤ |-140-freezer probe warm limit|-5

6.1.4.1.8. Document on Appendix B if the equation is true and if results are acceptable.

6.1.4.1.9. If the equation is true, the freezer probe is within acceptable range of the NIST thermometer probe.

6.1.4.1.10. If the equation is false, the freezer probe is not within acceptable range of the NIST thermometer probe.

6.1.4.1.10.1. If unit is SSF owned, notify SSF management and document as an OOS per SF-1-10. Initiate repair if warranted.

6.1.4.1.10.2. If unit is not SSF owned, notify SSF management as well as the owner of the unit. Complete an OOS per SF-1-10. Corrective action is the responsibility of the owner.

6.1.4.1.11. Record results and actions on Appendix B.

6.1.4.2. Check stair's slip resistant strips on each freezer for peeling and cracking

6.1.4.2.1. If repairs are required, notify SSF Management to initiate repair (SSF if owned by SSF or PI if PI-owned).

6.1.4.2.2. Observe and record results on Appendix B.

6.1.4.3. Check Styrofoam Lid integrity on each freezer for chipping and cracking

6.1.4.3.1. If repairs are required, notify SSF Management to initiate repair (SSF if owned by SSF or PI if PI-owned).

6.1.4.3.2. Observe and record results on Appendix B.

6.1.4.4. Check Gas Bypass

6.1.4.4.1. Visually check for physical damage to bypass on back of freezer. Check that bypass is tightly connected to freezer.

6.1.4.4.2. Press the Start Fill button.

6.1.4.4.3. Observe that the gas bypass vent opens.

6.1.4.4.4. Press the Stop button.

6.1.4.4.5. If repairs are required, notify SSF Management to initiate repair (SSF if owned by SSF or PI if PI-owned).

6.1.4.4.6. If gas bypass does not function as expected, complete an OOS per SF-1-10.

6.1.4.4.7. Observe and record results on Appendix B.

6.1.4.5. Perform a Freezer Alarm Functionality Test per SF-2-4 to verify that alarm still functions as intended.

6.1.4.5.1. **Activating Unit Alarm Test Function:**

6.1.4.5.2. On the LN_2 unit monitor, hit the setup button, if password is required, hit enter four times. If that does not work, refer to manual or ask PI.

6.1.4.5.3. Select temperature menus by hitting the enter button.

6.1.4.5.4. Select Temp A; Hit setup button to scroll until you see alarm test.

6.1.4.5.5. To begin alarm test, use the up arrow button to change from 'no' to 'yes'. Hit enter and temperature A will start getting warmer. If temperature begins to return to normal temperature before the alarm system delay has passed, begin alarm test again using step 6.1.4.5.5.

6.1.4.5.6. After alarm test is complete, the temperature will return to actual temperature of LN_2 freezer and the alarm test function will automatically return to 'no'.

6.1.4.6. Document completion of testing on Appendix B of this SOP. Completion of SF-2-4 Appendix J is not required.

6.1.4.7. If alarm does not function as intended, notify SSF management and complete an OOS per SF-1-10.

6.1.5. Alternatively, display calibration verification and other routine maintenance performed by a contractor are acceptable if SSF standards are met (per sections 6.1.3 and 6.1.4) and/or unit owner accepts vendor documentation and procedure as adequate. Alarm testing must be performed by SSF personnel as described in 6.1.4.5 and may not be delegated to a contractor.

6.1.5.1. If calibration verification is completed by contractor, documentation must be provided.

6.1.5.2. Documentation must include NIST-traceability of any temperature measurement instrumentation used.

6.1.5.3. If any information was not provided on vendor documents that are required per SSF standards, notify owner of unit to determine if the supplied documentation is acceptable as is.

6.1.5.3.1. If the owner deems the documentation to be acceptable, attach proof of acceptability (ie. email) and vendor documentation to Appendix B.

6.1.5.3.2. If the owner deems the contractor documentation to be unacceptable, and if the owner does not want the vendor to repeat the calibration (or if the due date is approaching), SSF personnel will attempt to perform the required calibration verification and routine maintenance as described in sections 6.1.3 and 6.1.4. If the owner <u>does</u> want the vendor to repeat the calibration, ensure that this is completed prior to the due date.

6.1.5.4. After PM completion by vendor:

6.1.5.4.1. Ensure that the "as-found" temperatures as documented by the vendor were within acceptance criteria. If the "as-found" temperatures were OOS, notify SSF management or owner of unit and complete an OOS per SF-1-10. If the "as-left" values could not be brought within specification during the calibration by the vendor, initiate repair.

6.1.5.4.2. Ensure that the "as-found" LN2 levels as documented by the vendor were within acceptance criteria. If the "as-found" LN2 values were OOS, notify SSF management or owner of unit and complete an OOS per SF-1-10. If the "as-left" values could not be brought within specification during the calibration by the vendor, Initiate repair.

6.1.5.4.3. Once temperatures and level are within normal parameters, verify that the LN_2 temperature probes have not been moved from their original position, by visually inspecting that the probe depth setting marker (an indicator on the probe's cable) is immediately above the insulating putty at the opening of the freezer's probe channel entrance.

6.1.5.4.3.1. If the probe depth setting marker is not visible or above the edge of the insulating putty, place a new mark (using paint or durable ink) on the LN_2 depth probe cable at the point at which the cable enters the putty (at the entrance of the freezer's probe channel). Cover the probe depth setting marker with clear tape.

6.1.5.4.3.2. Old probe depth setting markers that are found to be out of place must be removed (using appropriate product, such as environment grade ETOH for latex paint) after new mark has been established.

6.1.5.5. All routine maintenance as described per Section 6.1.3 and 6.1.4 must be completed. If the contractor fails to complete/document required maintenance defined in this SOP, it is the responsibility of the SSF personnel to complete the remainder of the maintenance and document on Appendix B.

6.1.6. **As Needed**

6.1.6.1. In event of OOS Temperature, unexplained by freezer access, proceed as follows:

6.1.6.1.1. Verify that probe hasn't moved from set position, by verifying that the probe depth setting marker (an indicator on the probe's cable) is immediately above the putty that is insulating the channel entrance.

6.1.6.1.2. If probe is correctly located, complete temperature calibration verification per Step 6.1.4.1.

6.1.6.1.3. If neither attempt solves the OOS Temperature, proceed per below.

6.1.6.1.3.1. If unit is SSF owned, notify SSF management and document as an OOS per SF-1-10. Initiate repair if warranted.

6.1.6.1.3.2. If unit is not SSF owned, notify SSF management as well as the owner of the unit. Complete an OOS per SF-1-10. Corrective action is the responsibility of the owner.

6.2. **Non-Routine Monitoring**

6.2.1. Documentation and follow-up of OOS conditions per SOP SF-1-10 (between action/alarm limit and acceptable range, for which NO alarms are generated) that occur at time points other than the routine temperature check is optional.

6.2.2. Documentation and follow-up of OOS conditions per SOP SF-1-10 (at or above the action limit for which there is an audible or visual alarm, but a Siemens alarm is NOT generated) that occur at time points other than the routine temperature check is optional.

6.2.3. Documentation and follow-up of OOS conditions per SOP SF-1-10 for which a Siemens alarm is received are performed as defined in SOP SF-1-10 and as defined in step 6.1.1.2.4 for overfills.

6.3. Parameter changes for non-SSF units are documented on Appendix A during the month in which the change is initiated and as defined in SOP SF-1-4.

6.3.1. Appendix C is updated to reflect the new parameters.

6.4. Retain copies of all SSF-owned unit repair documentation with freezer logs in the Operations Manager's office.

7. REFERENCES

7.1. ISBER Best Practices (current version)

8. DOCUMENTATION

8.1. Maintenance and Monitoring Logs are submitted for review to SSF Management and maintained per SF-1-6 Controlled Document Management SOP.

8.2. Deviations are managed per SF-1-9 SOP for Deviation Management.

8.3. Out-of-Specification (OOS) events are managed per SF-1-10 OOS Response and Notification Management SOP.

9. APPENDICES

9.1. The current version of each of the following appendices is used to guide and/or implement this SOP:

APPENDIX A: LN_2 Freezer Daily and Monthly Monitoring and Maintenance Log (1 Page)

APPENDIX B: LN_2 Freezer Quarterly, Semi-Annual, and Annual Monitoring and Maintenance Log (1 Page)

APPENDIX C: Template of the freezer SN specific Acceptable ranges for LN_2 level and probe temperatures. (1 Page)

APPENDIX D: Temperature Display Calibration Verification Spreadsheet Calculator (1 Page)

Month: _____ **Year:** _____

LN_2 Freezer Daily & Monthly Monitoring and Maintenance Log

Unit ID:

Date	Temperature (°C) Top Probe *Acceptable Range:* ____ - ____ °C	Temperature (°C) Bottom Probe *Acceptable Range:* _____ - _____ °C	LN_2 Level inches Acceptable _____ - _____ Inches	All Ranges Acceptable (Y=yes) (N=no)	Initials	Comments / Corrective Actions
1				Y N		
2				Y N		
3				Y N		
4				Y N		
5				Y N		
6				Y N		
7				Y N		
8				Y N		
9				Y N		
10				Y N		
11				Y N		
12				Y N		
13				Y N		
14				Y N		
15				Y N		
16				Y N		
17				Y N		
18				Y N		
19				Y N		
20				Y N		
21				Y N		
22				Y N		
23				Y N		
24				Y N		
25				Y N		
26				Y N		
27				Y N		
28				Y N		
29				Y N		
30				Y N		
31				Y N		

Reviewed By:

[1] Unit out of service.

Year:

LN_2 Freezer Quarterly, Semi-Annual, & Annual Monitoring and Maintenance Log

Unit ID: _____

Quarterly Wipe Down	Quarter	Completed Yes / No	Initials / Date	Quarter	Completed Yes / No	Initials / Date
	1	☐Yes ☐No		3	☐Yes ☐No	
	2	☐Yes ☐No		4	☐Yes ☐No	

Quarterly Wipe Downs Reviewed:
(Initials / Date)

Semi-Annually		LN_2 Level Digital Display:	LN_2 Level Manual Reading	Difference: *Acceptable Range ≤ 1 inch*	Acceptable	Initials/ Date	Comments / Corrective Actions (required if not acceptable)
	Month						
Liquid Nitrogen Level Display Verifi-cation					Yes No		
					Yes No		

Semi-Annual #1 Reviewed:
(Initials / Date)

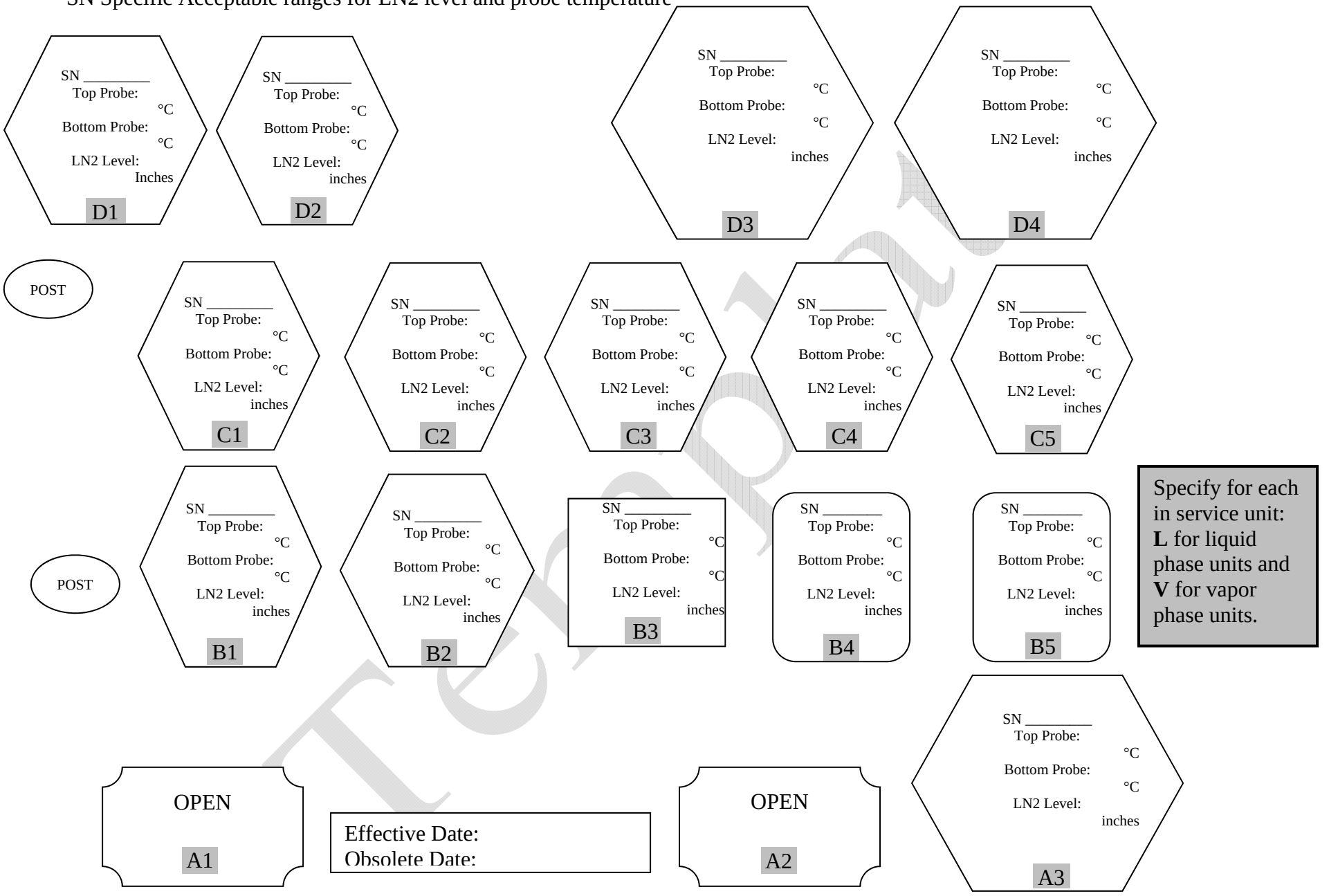
Semi-Annual #2 Reviewed:
(Initials / Date)

Annually	Unit Digital Display	NIST Temperature	Is the following equation true? |**NIST reading-unit digital display**| ≤ |**-140-freezer probe warm limit**|**-5**	Acceptable	Initials/ Date	Comments / Corrective Actions (required if not acceptable)
NIST S/N :			Re-calibration Due Date:			
Temperature calibration verification			Yes No	Yes No		
Alarm Functionality Test (performed per SF-2-4)			Completed and Passed: Alarm delay reset to 15 minutes:	☐Yes ☐No ☐Yes ☐No		

	Observation	Acceptable Range	Acceptable	Initials/ Date	Comments / Corrective Actions (required if not acceptable)
Stair's Slip Resistant Strips Integrity	☐Minimal or no cracking/peeling ☐Other. See comments	Minimal or No Cracking or peeling	Yes No		
Styrofoam Lid Integrity	☐Minimal or no cracking/peeling ☐Other. See comments	Minimal or No Cracking or Chipping	Yes No		
Check Gas Bypass	☐Functional ☐No Damage ☐Other. See comments	Functional No Damage	Yes No		

Annual Reviewed:
(Initials / Date)

SN Specific Acceptable ranges for LN2 level and probe temperature



Template

Temperature Display Calibration Verification Spreadsheet
Instructions for completion

	Before Beginning:
	Ensure the unit has not been opened recently (signage placed prior to verification process)
	Ensure the NIST-traceable unit is calibrated at -196 °C
	Ensure the NIST-traceable unit is within its calibrated due date
	Ensure that the NIST-traceable unit equilibrates for the allotted time define in the SOP
Step #	**NOTE: Step numbers correspond to steps listed in spreadsheet, but are performed in the order listed:**
1	Enter the unit ID by typing in the spreadsheet
2	Enter the unit S/N by typing in the spreadsheet
6	Enter the temperature from the NIST-calibrated unit as a negative number in the yellow box
7	Enter the temperature from the unit's digital display as a negative number in the blue box ******(record the value from the top probe if the freezer has two probes)***
8	Enter the warm probe's warm limit temperature as a negative number in the green box
N/A	Print the spreadsheet
N/A	Print the spreadsheet again after selecting "display formulas" from the menu bar
N/A	Document the following on the spreadsheet that **does not contain the formulas**
3	Record Technician Initials by hand
4	Record Date of Calibration verification by hand
5	Enter any pertinent comments by hand
9	Circle the result as Pass or Fail
10	Submit both pages for review & signature (On the page that does not contain the formulas)

Temperature Display Calibration Verification Spreadsheet

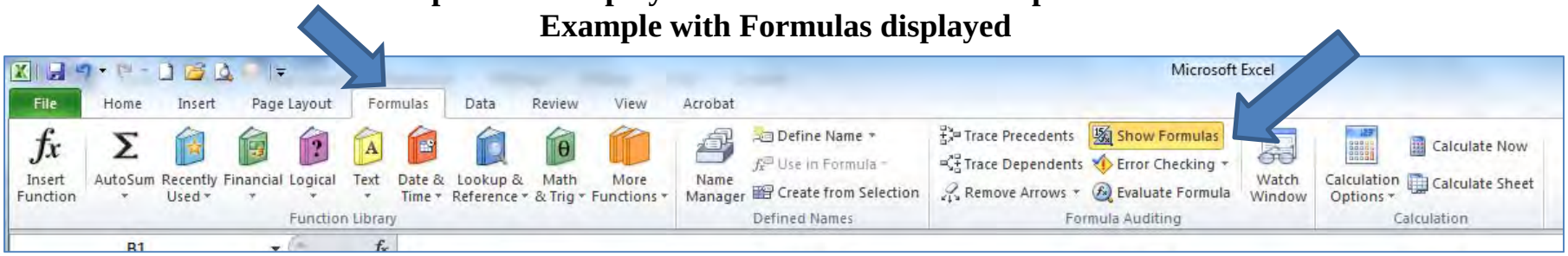
Example Spreadsheet – Blank

	A	B	C	D	E	F	G
1							
2		SOP SF-3-2 LN2 Freezer Verification of Temeprature Display Calibration					
3		1. Unit ID:					
4		2. Unit S/N:					
5		3. Tech ID *(Handwritten)*:					
6		4. Date Performed *(Handwritten)*:					
7		**5. Comments:**					
8							
9		|NIST reading-unit digital display| ≤ |-140-freezer probe warm limit|-5					
10							
11		****ENSURE ALL VALUES ARE ENTERED AS NEGATIVE NUMBERS**					
12							
13		6. NIST Temperature Reading		℃			
14		7. Unit Digital Display		℃	0	≤	135
15		8. Freezer Warm probe limit		℃		TRUE	
16							
17		9. Circle Calibration Result:					
18		True = Pass					
19		False = Fail					
20							
21		10. Verification Step					
22		**Verified as Accurate By:** *(enter handwritten initials/date)*					
23							
24		**Initials:**					
25		**Date:**					

Example Spreadsheet - Completed

	A	B	C	D	E	F	G
1							
2		SOP SF-3-2 LN2 Freezer Verification of Temeprature Display Calibration					
3		1. Unit ID: X99					
4		2. Unit S/N: 123456789					
5		3. Tech ID *(Handwritten)*: ABC					
6		4. Date Performed *(Handwritten)*: 01.02.2099					
7		**5. Comments:** None					
8							
9		|NIST reading-unit digital display| ≤ |-140-freezer probe warm limit|-5					
10							
11		****ENSURE ALL VALUES ARE ENTERED AS NEGATIVE NUMBERS**					
12							
13		6. NIST Temperature Reading	-120	℃			
14		7. Unit Digital Display	-185	℃	65	≤	25
15		8. Freezer Warm probe limit	-170	℃		FALSE	
16							
17		9. Circle Calibration Result:					
18		True = Pass					
19		False = Fail					
20							
21		10. Verification Step					
22		**Verified as Accurate By:** *(enter handwritten initials/date)*					
23							
24		**Initials:** XYZ					
25		**Date:** 01.03.2099					

Temperature Display Calibration Verification Spreadsheet
Example with Formulas displayed



	A	B	C	D	E	F	G
1							
2		**SOP SF-3-2 LN2 Freezer Verification of Temeprature Display Calibration**					
3		1. Unit ID:					
4		2. Unit S/N:					
5		3. Tech ID *(Handwritten)*:					
6		4. Date Performed *(Handwritten)*:					
7		**5. Comments:**					
8							
9		**|NIST reading-unit digital display| ≤ |-140-freezer probe warm limit|-**					
10							
11		****ENSURE ALL VALUES ARE ENTERED AS NEGATIVE NUMBERS**					
12							
13		6. NIST Temperature Reading		℃			
14		7. Unit Digital Display		℃	=ABS(C13-C14)	≤	=ABS(-140-C15)-5
15		8. Freezer Warm probe limit		℃		=OR(E14<G14,E14=G14)	
16							
17		9. Circle Calibration Result:					
18		True = Pass					
19		False = Fail					
20							
21		10. Verification Step					
22		**Verified as Accurate By:** *(enter handwritten initials/date)*					
23							
24		**Initials:**					
25		**Date:**					